

CLAIMS

1. Device for the continuous photocatalytic purification of the air of an inhabited room, preferably in the form of a wall panel (1), comprising:

- 5 - an external metal structure, preferably made of steel;
- an opening (11) for the intake of air to be treated, located at the bottom of the front part (10) of the wall;
- an internal metal frame (4) to which a series of UVA lamps (3) are attached;
- 10 - a filter (2) comprising a support covered by a film with photocatalytic titanium dioxide (TiO_2);
- an opening (12) for the outlet of the purified air, located at the top of the front part (10) of the wall, the airflow inside the device being ensured by natural
- 15 circulation or forced circulation with at least one fan (5);

characterised in that said device comprises at least one grate (2) made of expanded metal covered by a film with titanium dioxide (TiO_2) mainly in the anatase phase, so as

20 to maximise the surface of the photocatalyst illuminated by the UVA light.

2. Device according to Claim 1, characterised in that the external metal structure is made of steel or has an internal surface covered by a thin layer

25 with a reflective index greater than 90% for wavelengths shorter than 400 nm.

3. Device according to Claim 2, characterised in that the external metal structure is made of bright-annealed stainless steel.

30 4. Device according to Claim 1, 2 or 3, characterised in that the front part (10) of the external structure has a width of at least 1.5 metres, preferably 2 metres, and in that the intake and outlet openings (11,12) for the air are in the form of slits of equal width and of

a length slightly shorter than that of said front part (10) and of a height greater than 3 cm, preferably equal to 5 cm.

5 5. Device according to Claim 4, characterised in that said openings (11,12) are positioned less than 10 cm, preferably 5 cm, from the top and bottom ends of said front part (10), respectively.

10 6. Device according to any one of the preceding claims, characterised in that the expanded metal is an expanded steel and in that the entire surface of the meshes (6) of this expanded steel (S_{steel}) is covered with the TiO_2 film, with the exception of the surface of the thickness of the mesh, i.e.:

$$S_{steel} = \left[wS_{mesh} \sqrt{\left(\frac{LD_{mesh}}{2}\right)^2 + \left(\frac{SD_{mesh}}{2}\right)^2} - \frac{wS_{mesh}^2}{2\sin(2\arctg(\frac{SD_{mesh}}{LD_{mesh}}))} \right]$$

15 where LD_{mesh} , SD_{mesh} and wS_{mesh} are respectively the long diagonal, the short diagonal and the strip of the mesh.

20 7. Device according to Claim 6, characterised in that the mesh (6) is selected to minimise the ratio (S_{steel}) between its physical surface (S_{steel}) and its total surface (S_{mesh}):

$$S_{steel} = \frac{S_{steel}}{S_{mesh}} = \frac{4}{LD_{mesh}SD_{mesh}} S_{steel}$$

said ratio preferably being 1/3.

25 8. Device according to any one of the preceding claims, characterised in that the grate (2) is maintained vertically with fixings located only on the perimeter of the grate.

30 9. Device according to any one of the preceding claims, characterised in that the UVA lamps (3) are arranged in series of three across the width of the wall.

10. Device according to any one of the preceding claims, characterised in that the fan (5) is of a tangential type set at 90° and is located at the top of the wall, the number of fans being selected to ensure that at
5 least 30 m³/hour/person of air is renewed in an inhabited room.

11. Device according to Claim 1, 2 or 3, characterised in that it has the form of a cylinder of circular, rectangular or square cross-section with at least
10 one UVA lighting tube along the axle of the cylinder and surrounded by an expanded metal grate covered by photocatalytic TiO₂, the internal surface of the cylinder having an reflective index greater than 90%.

12. Use of the purification device according
15 to any one of Claims 1 to 11 for the destruction of volatile organic compounds such as alkanes, alcohols, aldehydes, ketones, aromatics and terpenes by photocatalysis of titanium dioxide.

13. Use of the air purification device
20 according to any one of Claims 1 to 10 in the construction sector, in the form of a structural or decorative element such as a wall panel, dividing wall, floor, ceiling or false ceiling, said element having an external metal surface covered with a finish such as plaster, paint or
25 wallpaper.

14. Use of the air purification device according to Claim 11 in the form of an air duct.

15. Method for optimising the sizing of an air purification element according to any one of Claims 1
30 to 10, characterised by the following steps:

- a) definition of the external geometry of the device;
- b) definition of the number of grates (2) made of expanded steel and of the illumination device (3);

- c) calculation of the illumination of the grates; if the light intensity is not greater than the set threshold, return to step b);
- d) calculation of the airflow and of the temperature distribution; if the steel walls (11,15) heat up, return to step b);
- e) calculation of the change in the pollutant concentration; if the overall efficiency of purification is not greater than the predefined limit, return to step b);
- f) achieving the purification or pollution-removal element with optimum dimensions.